END FACE POLISHING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to an end face polishing device polishing end face of bar member such as optical communication fiber.

In the end face polishing device of the related art, polishing is performed by pressing a polishing disc moving by combination of rotation and revolution on an end face of a fixed bar member as described in Japanese Patent Laid-Open No. 296451/2000. Locus of polishing has shape where plural circles moving on circumference of radius r to center P overlap continuously as showing locus 1 in Fig. 1. The state making a circuit of an external circumference 2 of the locus 1 is shown in Fig. 2. As shown in Fig. 2, an internal circumference 3 of the locus 1 has much overlapping of the locus, abrasion quantity of a polishing sheet increases, and the polishing sheet can not be used uniformly, thereby efficient use of the sheet is difficult.

Then, an object of the invention is to prevent local concentration of the locus overlapping of polishing on the polishing sheet and to improve efficiency of polishing.

In the polishing device of related art, locus of end face on the polishing sheet consists of circles moving on circumference, it is needed to increase rotational speed of

rotation or revolution in order to increase polishing speed. At increasing the rotational speed, there is a problem that scattering of abrasive liquid caused by centrifugal force occurs so that polishing is difficult.

SUMMARY OF THE INVENTION

In the invention, an end face polishing device comprising a pressing unit pressing an end face of a fixed bar member to a polishing sheet and a driving unit driving the polishing sheet in roulette shape moving while rotating on circumference parallel to the end face of the bar member is used. Here, the roulette means a curved line where a fixed point on another curved line moves when another curved line rolls along a fixed curved line.

Then in the invention, a method for polishing an end face having steps of pressing an end face of a fixed bar member to a polishing sheet, driving the polishing sheet in roulette shape moving while rotating on circumference parallel to the end face of the bar member, and making the end face for polishing disc is used.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view showing polishing locus of the polishing device of related art;

Fig. 2 is a plan view showing polishing locus of the polishing device of related art;

Fig. 3 is a view showing a polishing mechanism according to the invention;

Fig. 4 is a sectional view of a polishing device according to the invention;

Fig. 5 is a plan view showing polishing locus of the polishing device according to the invention;

Fig. 6 is a plan view showing polishing locus of the polishing device according to the invention;

Fig. 7 is a plan view showing polishing locus of the polishing device according to the invention;

Fig. 8 is a plan view showing polishing locus of the polishing device according to the invention;

Fig. 9 is a plan view showing polishing locus of the polishing device according to the invention; and

Fig. 10 is a plan view showing polishing locus of the polishing device according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The invention is an end face polishing device comprising a pressing unit pressing an end face of a fixed bar member to a polishing sheet and a driving unit driving the polishing sheet in roulette shape moving while rotating on circumference parallel to the end face of the bar member. By using roulette, relative speed of end face of a bar member to a polishing sheet varies, and polishing speed can be increased at high area in relative

speed. Oppositely, in low area in relative speed, time that polishing liquid flows into area where quantity of polishing liquid decreases by contact of the end face on the polishing sheet increases, quantity of the polishing liquid becomes constant even when loci of polishing are overlapped, and high symmetric to axis of the bar member, that is, little eccentric polishing becomes possible.

In the invention, the polishing device has a rotating shaft eccentric from revolution center of a first revolution shaft in the revolution shaft, a second revolution shaft eccentric from the rotation center of the rotation shaft in the rotation shaft, and a polishing disc connected to the second revolution shaft.

Further, in the end face polishing device, the second revolution shaft has an internal gear fixed at a frame of the end face polishing device, a first transfer gear engaging with the internal gear, a rotation shaft having a second transfer gear at opposite end portion of the end portion of the first transfer gear, and an external gear engaging with the second transfer gear.

Fig. 3 is a view showing characteristic part of the driving mechanism of the polishing device according to the invention. In the figure, the whole performs revolution RE1. Revolution center of revolution shaft and center position are eccentric R, and inner part of rotation shaft RO rotating by the external

gear EG1 engaging with the gear IG1 is performed with revolution RE2 to rotation shaft by revolution of the gear G2 engaging with the gear G1 driven by the external gear EG2 engaging with the internal gear IG2.

In the end face polishing device, the first revolution shaft is connected to a motor through a timing belt.

In the end face polishing device, the rotation shaft is connected to a motor through another timing belt.

Further, the end face polishing device has an ultra sonic actuator contacting outer circumference portion of the first revolution shaft and revolving the revolution shaft. By using the ultra sonic actuator, a polishing device of high torque and small size can be obtained.

The invention has steps of pressing an end face of a fixed bar member to a polishing sheet, driving the polishing sheet in roulette shape moving while rotating on circumference parallel to the end face of the bar member, and making the end face for polishing disc.

Here, the roulette may be cycloid. Further, the roulette may be internal cycloid. Moreover, the roulette may be external cycloid.

Further, the roulette may be relative trocoid inscribed to a first circle and drawn by a point fixed at a second circle smaller in diameter than the first circle. The roulette may be relative external trocoid inscribed to the first circle and

drawn by a point fixed at out of the second circle smaller in diameter than the first circle.

Especially, the roulette may be relative internal trocoid inscribed to a first circle and drawn by a point fixed in the second circle smaller in diameter than the first circle.

Here, an XY table can be used for driving the polishing sheet. By using the XY table, a polishing device can be designed without using complex driving mechanism of rotation system such as an epicyclic gear for usual rotation and revolution. Further, by using large XY table in a moving distance, the polishing sheet is kept away far from the bar member, the state of the end face of the bar member in the middle of polishing, a polishing sheet different in roughness is arranged at another area of the XY table, the same polishing device can be used from coarse polishing to finishing polishing.

By varying the driving speed using a single sheet or plural sheets, polishing speed can be decreased at initial coarse polishing so as to reduce load to driving system large in frictional resistance. Because frictional resistance is small at finishing polishing, driving speed is increased, and polishing speed is increased so as to reduce whole polishing time.

EXAMPLE

An example according to the invention will be described in detail referring figures. Fig. 4 is a sectional view showing

driving mechanism of the end face polishing device according to the invention. An elastic body 30 is arranged on a top portion of a polishing disc 10 through a frame 20 of an external circumference, a polishing sheet 40 is arranged on the elastic body 30, an end face of a bar member is pressed to the sheet 40, so polishing is performed.

Lower face side of the polishing disc 10 and a flange 60 on a revolution shaft 50 are connected through plural fixed pins 70a and 70b, and the polishing disc 10 is supported by the revolution shaft 50. The revolution shaft 50 is connected to a rotation shaft 80 at eccentric position in designated quantity to the rotation shaft 80 through a transfer unit 90 and a fixed pin 91. A lower part of the revolution shaft 50 engages with a transfer gear 100, and the transfer gear 100 is connected to a transfer gear 101 coaxially. The transfer gear 101 engages with an internal gear in the frame of main body of the polishing device.

The lower part of the revolution shaft 80 are connected to a rotation portion 230 through a timing belt 220 arranged at outer side of a pulley 210 connected to a driving shaft of a motor 200 and engages with an internal gear of the rotation portion 230.

A revolution shaft 300 is connected to the driving shaft of the motor 200 though a pulley 310 and a timing belt 320. The rotation shaft 80 is arranged in the revolution shaft 300.

Locus of polishing of the polishing device according to the invention will be described below. Fig. 5 is a view when revolution radius in the rotation shaft is large, and the locus is a continued locus 1 where a shape 4 consisting of a roulette of cycloid shape having sharp points 5 revolves in the external circumference 2 where circumference of radius r is center through center P of external circumference 2. Then, overlapping of locus of the internal circumference portion 3 is removed.

Fig. 6 is a view where the locus 1 goes around in the external circumference 2.

Fig. 7 is a view when revolution radius in the rotation shaft is small, a shape 6 of locus becomes a shape of three leaves. By driving the shape continuously, the locus becomes like locus 1, further by going around in the external circumference 2, density of locus of the internal circumference 3 becomes low as the locus 1 of Fig. 8.

Fig. 9 is a view when further ratio of revolution diameter is varied, the locus becomes a shape 7 of locus having five times of symmetric axis in the external circumference 2. Fig. 10 is a view where similarly the shape of the locus 1 goes around driving continuously, high density locus 1 is obtained in the external circumference 2, and the polishing sheet can be used efficiently.

According to the invention, since locus of the end face of roulette shape moving while rotating on the circumference

is obtained, life of the polishing sheet can be made long so as to obtain a short polishing device in polishing time.